

## SIMULATION OF DSTATCOM FOR POWER FACTOR IMPROVEMENT

HARSHKUMAR SHARMA<sup>1</sup>, GAJENDRA R. PATEL<sup>2</sup> & RONAK GANDHI<sup>3</sup>

<sup>1</sup>Research Scholar, Electrical Department, SPCE, Visnagar, Gujarat, India

<sup>2</sup>Assistant Professor, Electrical Department, SPCE, Visnagar, Gujarat, India

<sup>3</sup>Research Scholar, Electrical Department, SPCE, Visnagar, Gujarat, India

### ABSTRACT

*The main aim of this paper is to represents an instantaneous power control of D- STATCOM for power factor and power flow control. When installed DSTATCOM to reduces to power quality disturbance. DSTATCOM device is used for power quality enhancement and harmonic reduction in the power system but the proposed control strategy provides additional objectives for system performance improvement. In this paper improve line voltage, line current and power factor. To verify the use of DSTATCOM for given system there is power distribution feeder with a three-phase rectifier load was tested. The simulation results showed that power flow control and improve the power factor.*

**KEYWORDS:** DSTATCOM, Power Flow Control & Power Factor

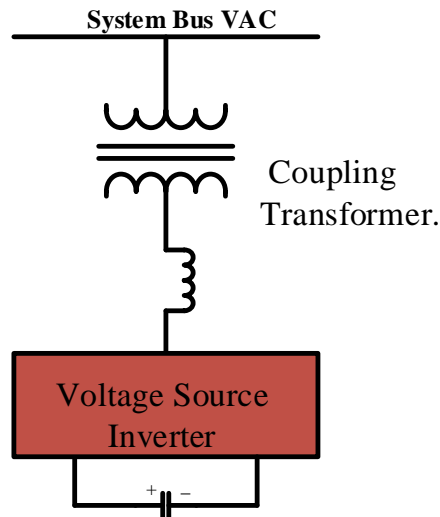
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### INTRODUCTION

Electric power distribution network have become increasingly important and essential role in power system. Power systems have a major function to secure distributed customer loads to feeder line. The quality of electrical power many be described as a set of values of parameters, like Continuity of service, Variation in voltage magnitude, Transient voltages and currents, harmonic content in the waveforms, etc. Power quality is an ability of system or equipment to function satisfactorily in its electromagnetic environment without intolerable, electromagnetic disturbances to anything in that environment. Power quality is a set at electrical boundaries that allow a piece of equipment to function in its intended manner without significant loss of performance. Power factor define as a ratio between the active powers of the fundamental wave to the apparent power of the fundamental wave. Power factor is the cosine of the displacement angle between the voltage and current. Most electrical equipment is a designed to operate within a voltage of (+ or – 5%) of nominal with marginal decrease in performance. In order most conditions for supply system from engineering and economic standpoint, it is main objective to have power factor as close to unity as possible. The power factor can be improved by connecting capacitor in parallel with the equipment operating at lagging power factor. Static capacitors are invariable used for power factor improvement.

### DSTATCOM

The voltage-sourced converter (VSC) is the basic electronic contain of a STATCOM, which converts the dc voltage into a three-phase set of output ac voltages Figure 1 shows the simplest implementation of a DSTATCOM. The STATCOM is a shunt connected reactive power compensation device that is capable of generating and absorbing reactive power and control of output parameter.



**Figure 1: Schematic Diagram of a Basic DSTATCOM**

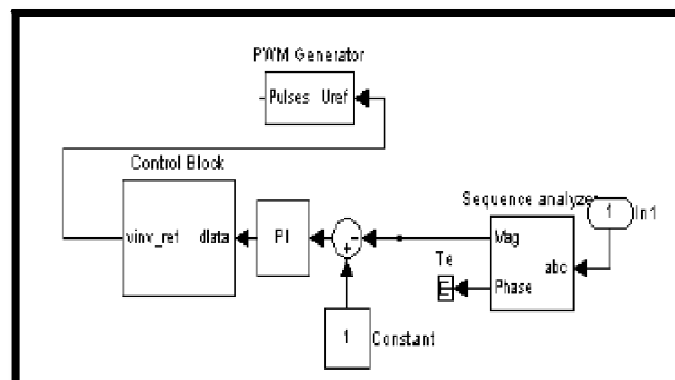
### Voltage Source Converter

Voltage source converter is convert dc voltage to ac voltage. When ac bus voltage system  $E_s$  greater then  $E_t$ , current flow from converter to system and generate capacitive reactive power for the system. When  $E_s$  less then  $E_t$ , so current flow from system to converter and absorb inductive reactance from system. When  $E_s$  equal to  $E_t$ , no exchange of reactive power. Voltage source converter produces a square voltage waveform as it switches the direct voltage source on and off. The main aim of a VSC is produce a sinusoidal AC voltage with minimum harmonic distortion from a DC voltage.

### Energy Storage Circuit

Energy storage circuit is connected in parallel with the DC capacitor. The DC capacitor could be the charged by the battery source. Capacitor connected parallel to circuit to maintain balance voltage.

### Controller



**Figure 2: Shows the Block Diagram of Controller System**

When line voltage value feedback to the DSTATCOM strategy. It gives to sequence analyzer and measure sequence of 3 phase power supply R, Y, B phase to positive, negative and zero phase sequence voltage compare with add block. Maintain regulated signal to given the PI controller generate error signal occur operating waveform and reference

value in subsystem include 3 phase sequence control strategy subsystem. Then after PWM compare output waveform in the triangular carrier signal waveform then different of pulses generate to given IGBT. IGBT triggering pulses differential injected DSTATCOM. IGBT triggering for pulses output value constant. Common DC link provided voltage balancing. Voltage value behind the absorb voltage value. Voltage value decreases the injected voltage in the subsystem. Subsystem injecting transformer disconnected distribution line transformer mitigation voltage will be injecting transformer mitigation.

## MODELLING AND SIMULATION

### Modeling Of 3-Phase System without DSTATCOM

In the 3-phase system the power factor and active, reactive power parameters are very important as discussed in the above sections of this project. Now in the proposed system first of all we take a 3-phase system in which we create the 3-phase fault and check the values of power factor, line voltage, and line current and also check the effect on active and reactive power values. This is shown in the figure 4 below with the simulation results.

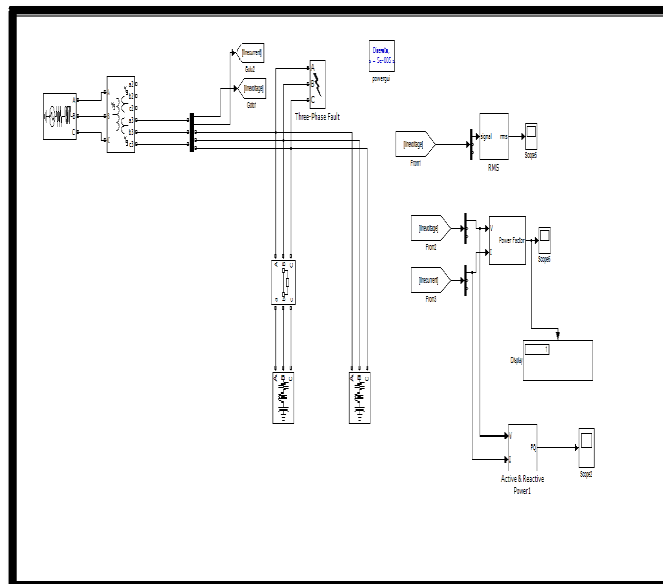


Figure 3: Three Phase System with the 3-Phase Fault and Measurements Block

## SIMULATION RESULTS

The simulation results in these sections shows the fluctuation in the value of power factor and it also shows the distortion and effect on active and reactive power also.

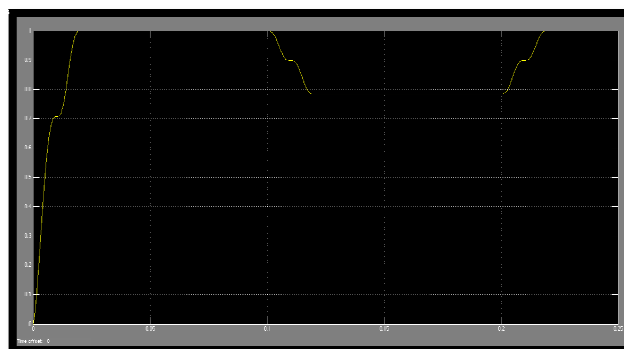


Figure 4: Distortion in Line Voltage Value

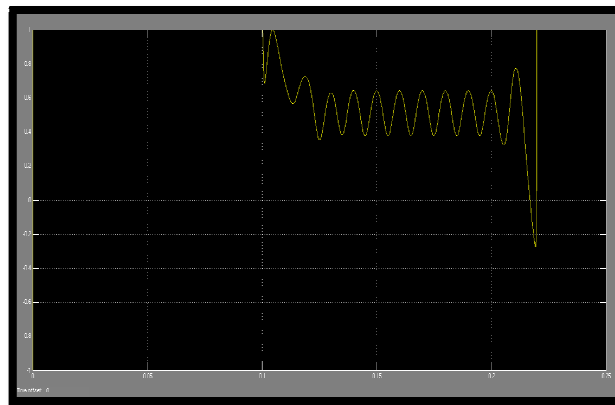


Figure 5: Fluctuation in Power Factor Value

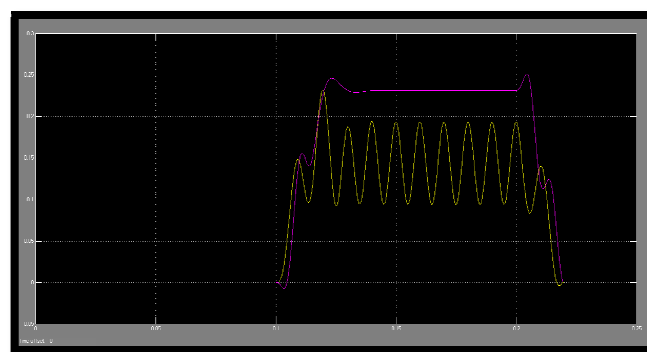


Figure 6: Active and Reactive Power Value Fluctuation

### Modeling Of 3 Phase System with DSTATCOM

Now we will provide STATCOM in the above proposed system with PI control strategy which will mitigate the distortion and fluctuation from the proposed system. Figure 7 below shows the 3-phase system with STATCOM and Control strategy of the proposed system with instantaneous power control theory which improves power factor and also provides control for active and reactive power value in the system.

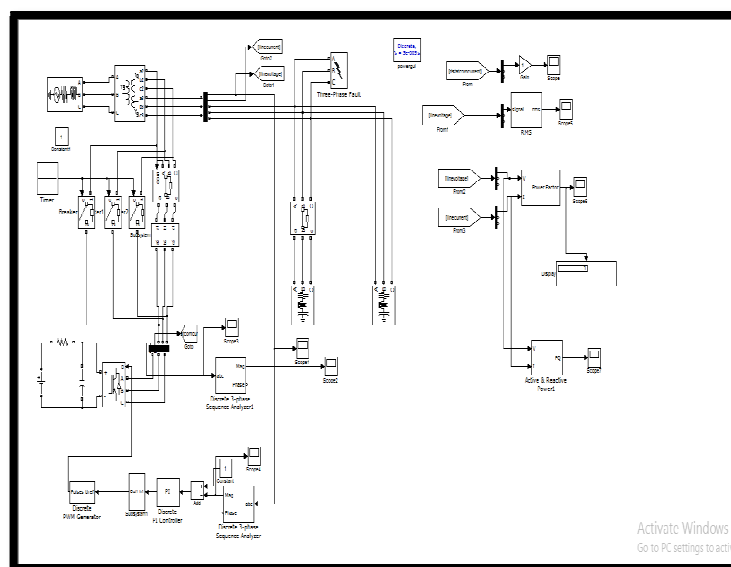


Figure 7: Proposed System with DSTATCOM Connected

### Simulation Results after Connection of DSTATCOM

Now after the proposed control strategy and simulation the DSTATCOM improves the power factor value and also shows that distortion and fluctuation are remove from the system. These are shown in the simulation results of figure bellows:-

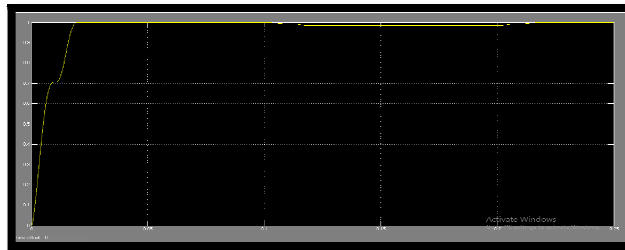


Figure 8: Line Voltage after DSTATCOM Connection

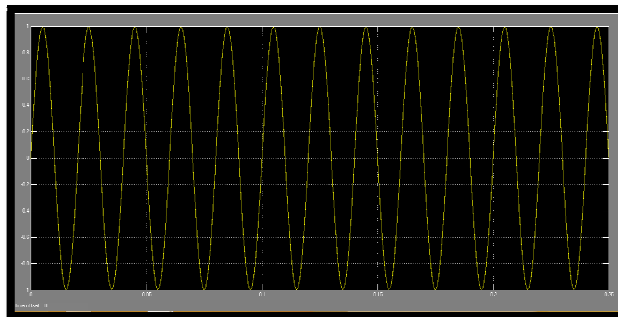


Figure 9: DSTATCOM Current Pure Sinusoidal

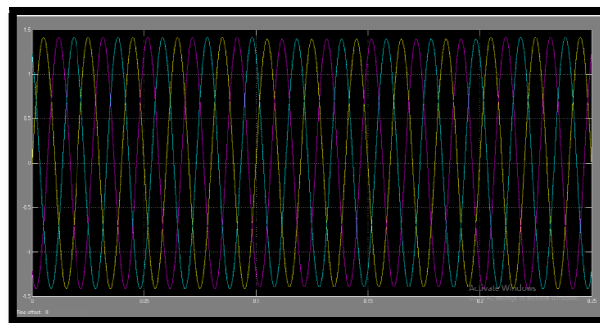


Figure 10: Three Phase System Output Pure Sinusoidal

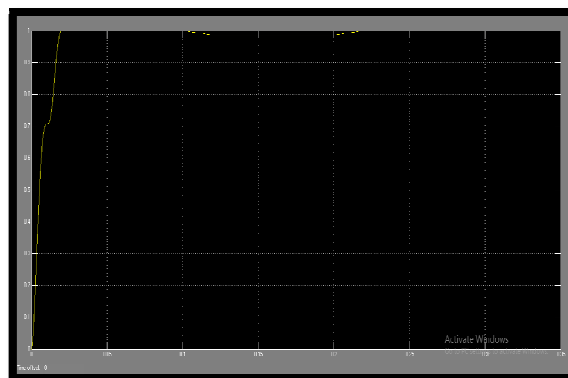


Figure 11: Improvement in Power Factor

## CONCLUSIONS

The line voltage and line current will disturb due to three phase fault in the 3 phase system. The simulation results shows that due to phase displacement in voltage and current and power factor value will also decreases. So it is necessary to improve the power factor value in the system. So here in this paper we connect the DSTATCOM and improve line voltage, line current value and which help us to improve power factor value. So the waveform at line voltage and line current becomes pure sinusoidal.

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